SOIL TEST BASED FERTILITY EVALUATION AND PREPARATION OF NUTRIENT MANAGEMENT PLAN

Dr. V. K. Venugopal
Former Professor & Head
Department of Soil Science and Agricultural Chemistry
College of Agriculture, Vellayani
Consultant, Digital University, Kerala

CDIPD
CENTRE FOR DIGITAL INNOVATION AND PRODUCT DEVELOPMENT

CENTRE FOR DIGITAL INNOVATION AND PRODUCT DEVELOPMENT
(A centre of excellence established by Digital University Kerala)
www.cdipd.duk.ac.in

DIGITAL UNIVERSITY KERALA
Curating a responsible digital world

NUTRIENT MANAGEMENT PLAN (NMP)

- Nutrient Management Plan is prepared based on the soil test data
- Assists the farmers in making best use of the right quantity of fertilizers and organic Manures
- Potential cost savings in inputs, balanced supply of nutrients, improved crop performance ,enhanced crop yields , quality, lesser environmental hazards due to excess of nutrients and overall improvement in soil health
- Can be used for planning fertilizer needs of the Panchayat, Block, District and the State as a whole
- NMP has to be periodically revised according to the farmers needs, season, change in cropping pattern etc

Components of a Nutrient Management Plan

- Amounts of nutrients present in the soil
- Quantity of lime and nutrients needed for the crop to provide balance supply of nutrients
- Accounting for all potential sources of nutrients used as inputs,form of manures/legumes in addition to fertilizers
- Recommendation for lime, manures, fertilizers,time and method of application to increase use efficiency
- Site management to minimize nutrient losses through surface and ground water
- Maintain records of soil test data and nutrient management practices carried out

Soil fertility classes for OC, P and K (KAU)

Soil fertility class	% of organic carbon		N as % of general recommendation	Available P ($kg\ ha^{-1}$)	Available K ($kg\ ha^{-1}$)	P and K as % of general recommendation	Soil Fertility Rating
	Sandy	Clayey/ loamy					
0	0.00 – 0.10	0.00-0.16	128	0.0 – 3.0	0 - 35	128	Low
1	0.11 – 0.20	0.17-0.33	117	3.1 – 6.5	36 -75	117	
2	0.21 - 0.30	0.34-0.50	106	6.6 – 10.0	76 -115	106	
3	0.31 - 0.45	0.51-0.75	97	10.1- 13.5	116-155	94	Medium
4	0.45 - 0.60	0.76-1.00	91	13.6 -17.0	156-195	83	
5	0.61 - 0.75	1.01-1.25	84	17.1 -20.5	196 -235	71	
6	0.76 - 0.90	1.26-1.50	78	20.6- 24.0	236 -275	60	
7	0.91 - 1.10	1.51-1.83	71	24.1- 27.5	276 -315	48	High
8	1.11 - 1.30	1.84-2.16	63	27.6 – 31.0	316 -355	37	
9	1.31 - 1.50	2.17-2.50	54	31.1- 34.5	356- 395	25	

SOIL FERTILITY RATINGS FOR AVAILABLE NUTRIENTS

- Soil analysis data for OC, Available P and K were grouped as low, medium or high as per soil fertility rating followed in Kerala
- Deficiency and adequate classes for secondary and micro nutrients

- Based on the number of samples falling in each category, frequency distribution diagrams are prepared for OC, available P and K ,C, Mg, Cu, Zn, and B

SOIL REACTION (pH) CLASSES

Classes	pH range	Lime (kg/ha)
1. Ultra acid	<3.5	1000
2. Extremely acid	3.5 -4.4	850
3. Very strongly acid	4.5- 5.0	600
4. Strongly acid	5.1-5.5	350
5. Moderately acid	5.6-6.0	250
6. Slightly acid	6.1-6.5	100
7. Neutral	6.6-7.3	
8. Slightly alkaline	7.4-7.8	
9. Moderately alkaline	7.9-8.4	
10. Strongly alkaline	8.5 -9.0	
11. Very strongly alkaline	>9.0	

Secondary Nutrient Classes

Classes	Ca (mg/kg)	Mg (mg/kg)	S (mg/kg)
Deficient	≤ 300	≤ 120	≤ 5
Adequate	> 300	> 120	> 5

Application of nutrient in deficient situation	Lime application	80 kg $MgSO_4$ per ha	25 kg S per ha or No S, if $MgSO_4$ is applied

MICRONUTRIENT CLASSES

Rating	Cu *	Zn *	B **
Deficient (mg/kg)	< 1.0	< 1.0	< 0.50
Adequate (mg/kg)	≥ 1.0	≥ 1.0	≥0.50
Application of nutrient in deficient situation	2 kg $CuSO_4$ per ha	20 kg $ZnSO_4$ per ha	10 kg Borax per ha

* HCl extractant ** Hot water soluble

Soil Test Summaries and Nutrient Iindex

Soil test summaries of different regions are useful in delineating areas of sufficiency and deficiency of one or more nutrients. When carried out over a period, they are useful in the study of changing patterns in soil fertility, fertiliser use, etc.

Nutrient Index as suggested by Parker *et al*. (1951)

$$\text{Nutrient Index} = \frac{(N_l \times 1) + (N_m \times 2) + (N_h \times 3)}{N_t}$$

where, N_l - Number of samples in low category,

Nm- Number of samples in medium

N_h- Number of samples in high category

Nt- Total number of samples

Nutrient index classes

Low : < 1.5 ; Medium : 1.5 -2.5 ; High : > 2.5

Based on the nutrient index, fertilizer recommendation (NPK) is given as the percentage of general recommendation now being followed by the State Soil Testing laboratories.

SOIL BASED PLANT NUTRIENT MANAGEMENT PLAN FOR

PALLIKKARA GRAMA PANCHAYAT

Block: Kanhangad **District: Kasargod**

In order to prepare the NMP, composite surface soil samples (0-20 cm) were collected from 280 farmer's fields, well distributed in the panchayat and representing the major land use systems.

Sample Analysis

- Analyzed for pH and EC
- Major nutrients: organic carbon, available P and K
- Secondary nutrients : calcium, magnesium, sulphur
- Micro nutrients: iron, manganese, copper, zinc and boron

General features of panchayat

- Pallikkara Grama Panchayat of Kanhangad Block in Kasargod District comprising of twenty two wards, spreads over an area of 3909 ha.
- Soil type comes under the Coastal Sand sub unit of Kaipad lands
- Climate is tropical humid monsoon type with mean annual rainfall of 3254 mm and mean annual temperature of 27.3°C.
- Nearly level sandy plains adjacent to the coastline comprising of beach sands, sandy ridges and sand depressions are the characteristic features.
- Soils are very deep, well drained sands ,acidic , shallow water table in certain places
- Coconut is the major crop followed by rice.
- The gross cropped area is 2539 ha.
- Area wise distribution of crops is presented

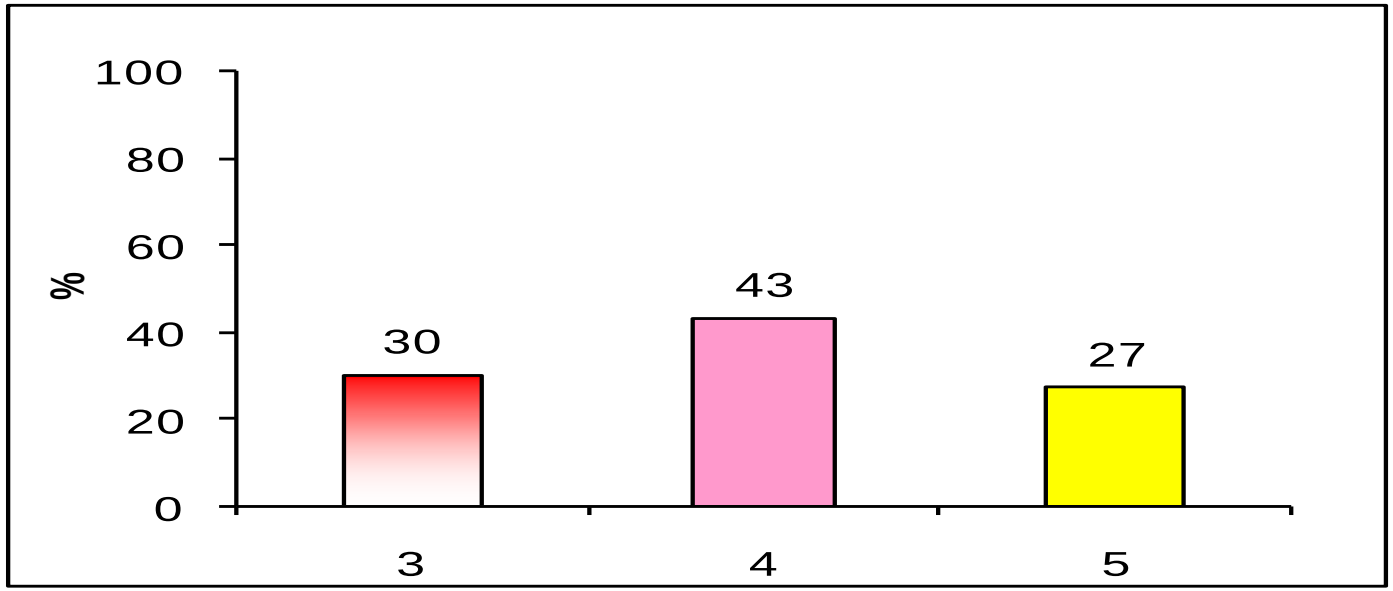
Area wise distribution of crops

Crop	Area (ha)	Crop	Area (ha)
Coconut	1741	Banana	35
Rice	232	Cashew	30
Areca nut	161	Others	266
Pepper	74		

Soil analysis results of (n=280) are interpreted considering soil fertility ratings for various nutrients and the NMP prepared for computing fertilizer recommendation for the panchayat.

The salient features of the soil test results of the panchayat are presented.

Frequency distribution of soil reaction (pH)

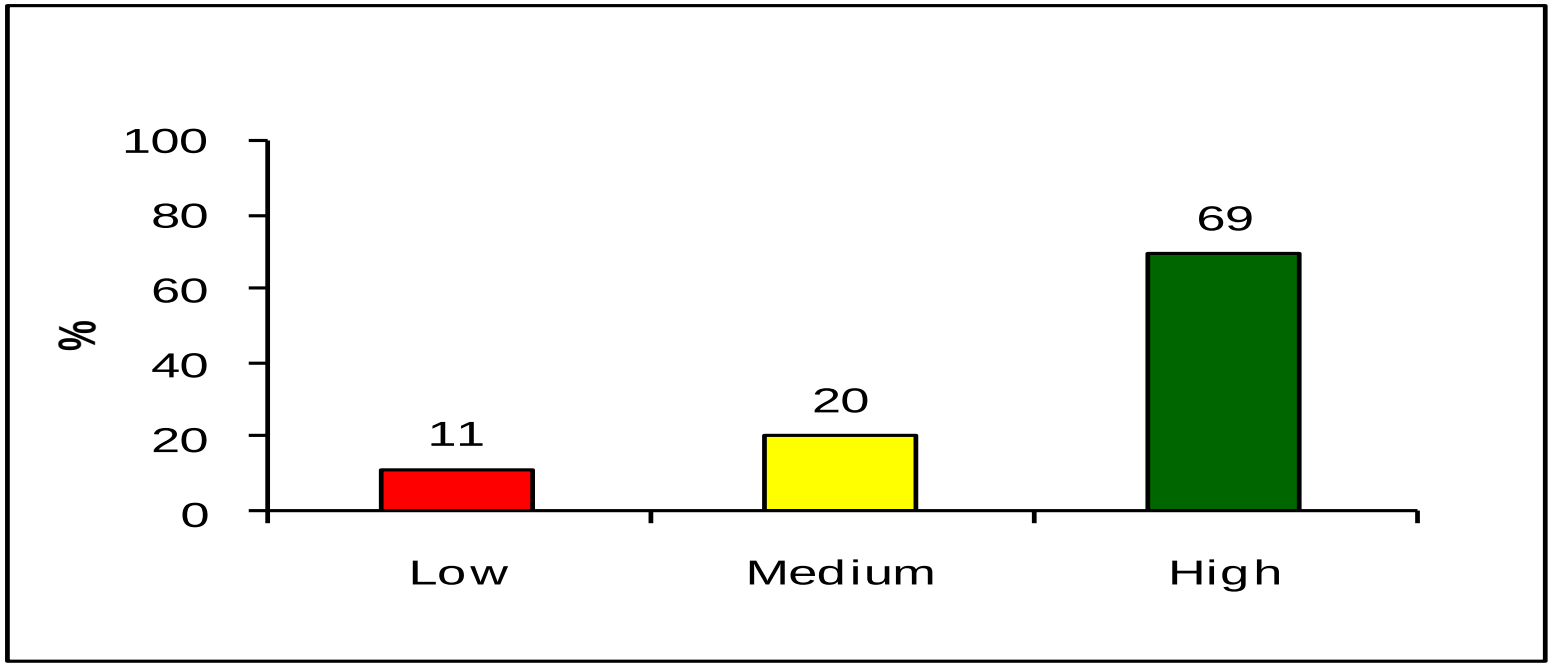


Very strongly acid to moderately acid

(pH range- 4.5 to 6.0)

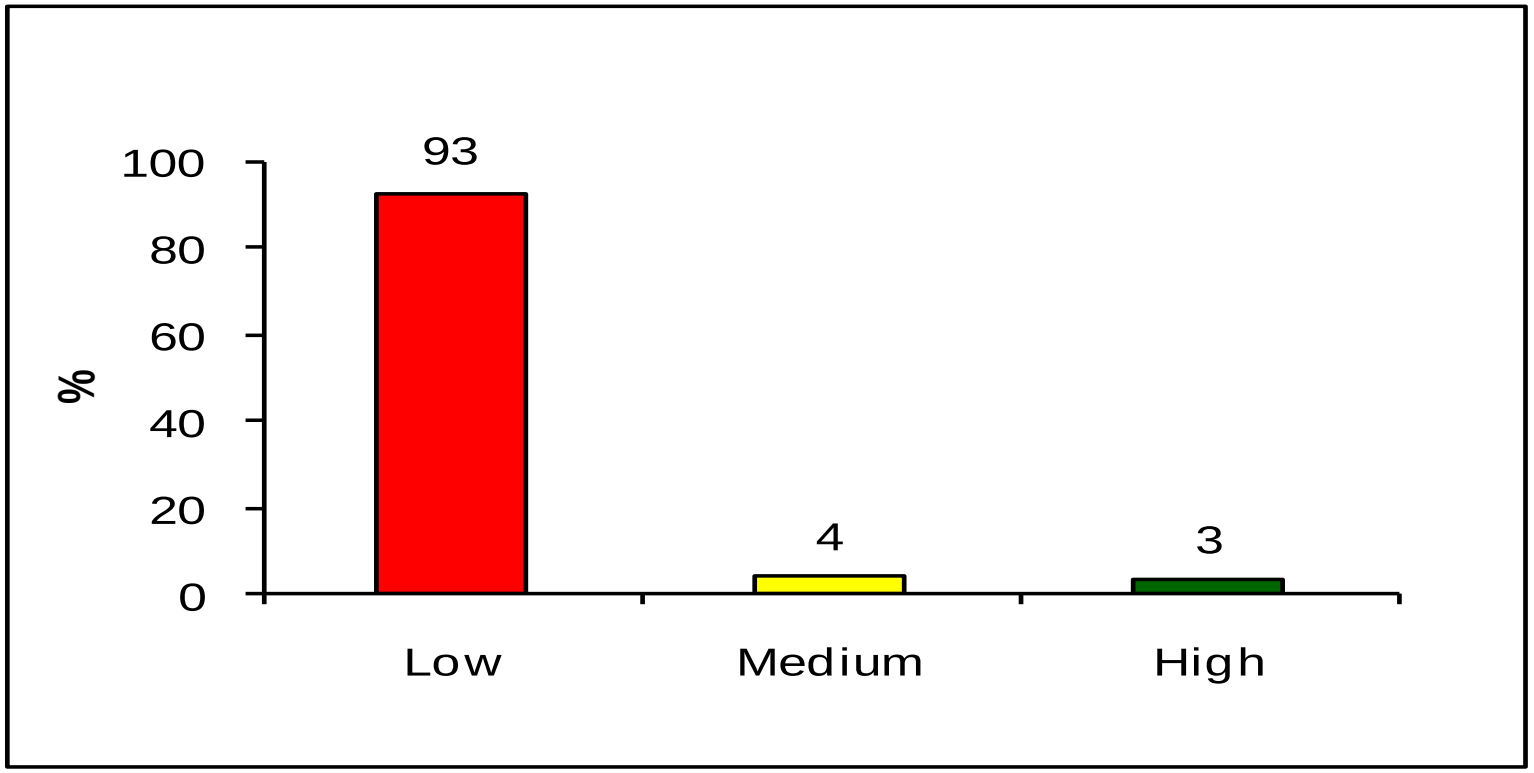
1- Ultra acid <3.5; 2- Extremely acid 3.5 -4.4; 3- Very strongly acid 4.5- 5.0 ; 4- Strongly acid 5.1-5.5 ; 5- Moderately acid 5.6-6.0; 6- Slightly acid 6.1-6.5; 7- Neutral 6.6-7.3; 8- Slightly alkaline 7.4-7.8; 9- Moderately alkaline 7.9-8.4; 10- Strongly alkaline 8.5 -9.0; 11. Very strongly alkaline >9.0)

Frequency distribution of organic carbon



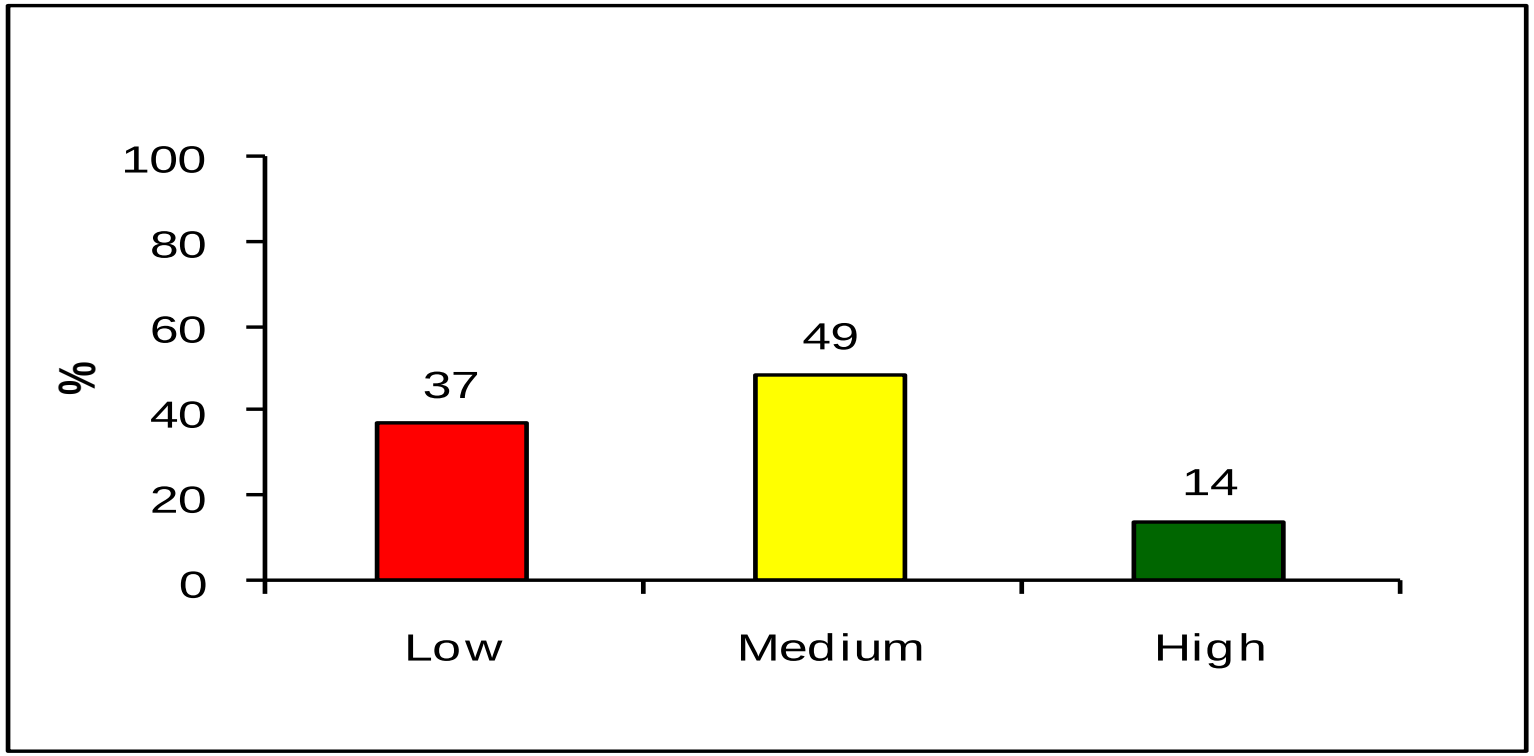
Nutrient Index Value
2.6 (High)

Frequency distribution of available P



Nutrient index value
1.1 (Low)

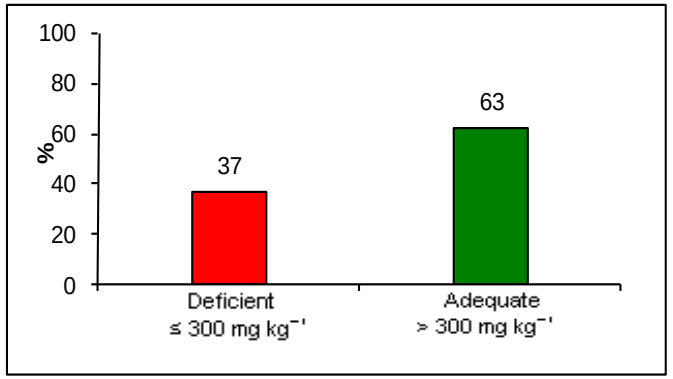
Frequency distribution of available K

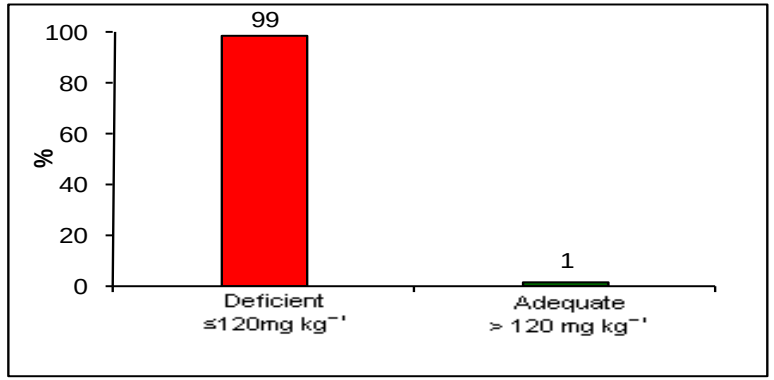


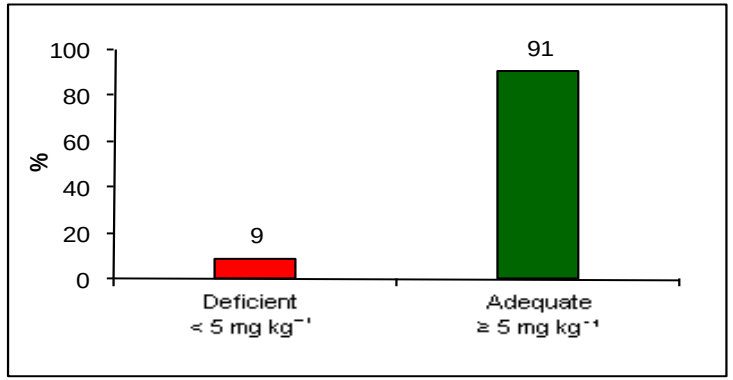
Nureient Index Value

1.8 Medium

Frequency distribution of calcium, magnesium and sulphur







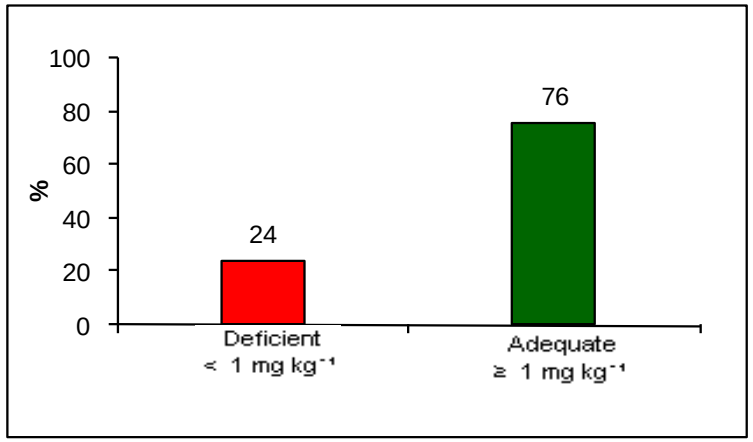
Ca
Deficient

Mg
Deficient

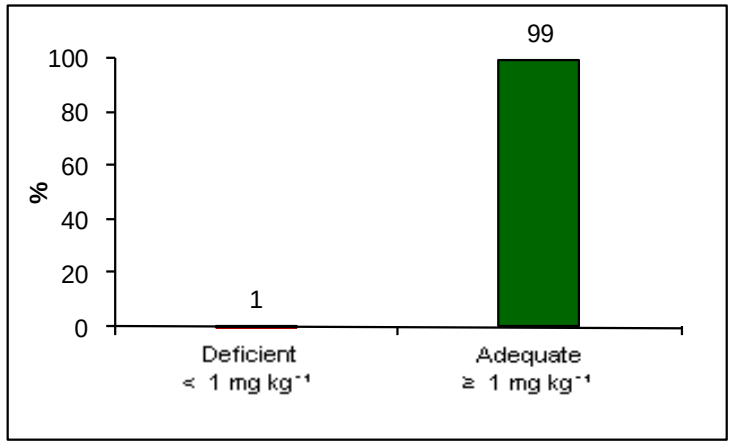
S
Adequate

Percentage of samples in adequate class ≥ 70 indicates sufficiency level of the nutrient in the panchayat)

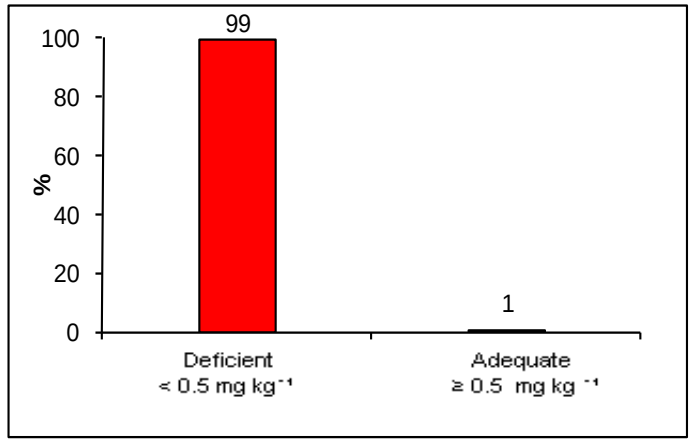
Frequency distribution of copper, zinc and boron



Cu
Adequate



Zn
Adequate



B
Deficient

Percentage of samples in adequate class ≥ 70 indicates sufficiency level of the nutrient in the panchayat

SOIL TEST RESULTS - SALIENT FEATURES

- soils are very strongly acid to moderately acid with overall pH ranging from 4.5 to 6.0
- Organic carbon is high in soil samples with content greater than 1.5 per cent.
- Indicated high level of plant available nitrogen in soils
- Available phosphorus is low in soil samples with values less than 11 kg ha^{-1}
- Available potassium is medium in soil with content ranging from 116 to 275 kg ha^{-1}
- Calcium is deficient in soil samples with content less than 300 mg kg^{-1}

- Magnesium is deficient in 99 per cent of soil with content less than 120 mg kg^{-1}
- Sulphur is adequate in 91 per cent of soil with content greater than 5 mg kg^{-1}
- Copper is adequate in soil samples with content greater than 1 mg kg^{-1}
- Zinc is adequate in 99 per cent of soil samples with content greater than 1 mg kg^{-1}
- Boron is deficient in 99 per cent of soil samples with content less than 0.5 mg kg^{-1}

General nutrient management suggestions

- Lime application @ 400 kg/ha calcium carbonate is recommended for correction of soil acidity and as calcium supplement.

- Farm yard manure to be applied as basal dose as per the Package of Practices (POP)recommendation

- Nitrogen application @ 75 per cent of POP

- Phosphorus application @ 125 per cent of POP

- Potassium to be applied @ 100 per cent of POP

General nutrient management suggestions (Contd..)

- Calcium application as per lime requirement to alleviate deficiency
- Magnesium to be applied as magnesium sulphate @ 80 kg ha^{-1}.
- Alternatively, a quarter of the lime recommended can be added as dolomite
- Sulphur is adequate and hence application not required
- Copper is adequate and hence application not required
- Zinc is adequate and hence application not required
- Boron in the form of borax @ 10 kg ha^{-1} or foliar spray of 0.5 per cent solution

Fertilizer recommendation of major crops

Crop	OM ($t\ ha^{-1}$)	Recommendation ($kg\ ha^{-1}$)					
		$CaCO_3$	N	P	K	$MgSO_4$	Borax
Rice(wet land,local)	5	400	30	25	20	80	10

Crop	OM ($kg\ plant^{-1}$)	Recommendation ($g\ plant^{-1}$)					
		$CaCO_3$	N	P	K	$MgSO_4$	Borax
Areca nut	12	300	75	50	140	60	20
Banana (Nendran)	10	160	150	145	300	35	5
Cashew	-	2280	565	400	750	450	50
Coconut	25	2280	375	400	1200	500	50
Pepper	10	360	75	65	140	200	15

Panchayat wise computation of NMP indicates only the general soil fertility status of the panchayat. However, site-specific fertilizer recommendation based on analysis of soil samples from individual farmer's field is more beneficial and economical.

Reference

Kerala State Planning Board, 2017, Soil Fertility Assessment and Information Management for Enhancing Crop Productivity in Kerala, State Planning Board, Thiruvananthapuram, pp 514


Thank You